Principles of Partial Denture Design

Forces acting on PD depend on

Age and sex of patient

Power of muscles of mastication

Type of opposing occlusion

Lateral forces are destructive , should be minimized to be within the physiological tolerance of the supporting structures

Forces falling on RPD should be:

Directed vertically

Within the physiological tolerance of the tissues

- Distributed widely to reduce the force/unit area

A properly constructed partial denture must achieve:

- ***Support (adequate distribution of the load to the teeth and mucosa)***
- ***Retention (sufficient resistance to vertical displacing forces)***
- ***Bracing (sufficient anchorage to resist horizontal forces)***
- ***Stabilization (sufficient resistance to resist tipping forces)***
- ***Reciprocation (Nullifying the effect of pressure on one side of a tooth by the application of pressure equal in amount but in opposing direction on the opposite side of the tooth)***

Types of RPD

- ***Tooth Support***

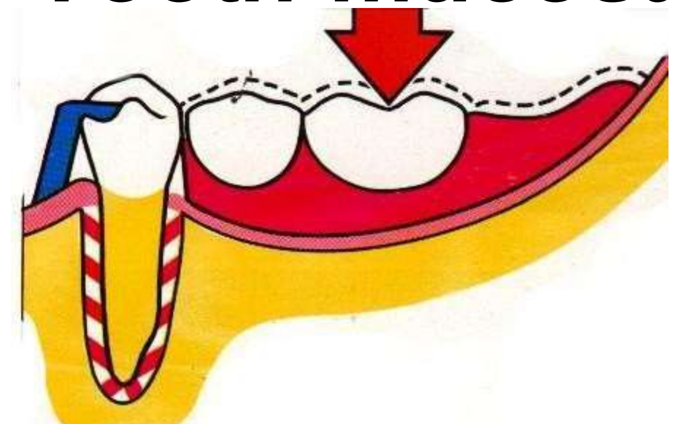




- ***Mucosa support***



- ***Tooth-mucosa support***



Movements of the partial denture

I. Tissue-ward movements

II. Tissue-away movements

III. Horizontal movements

a. Lateral movements

b. Antero-posterior movements

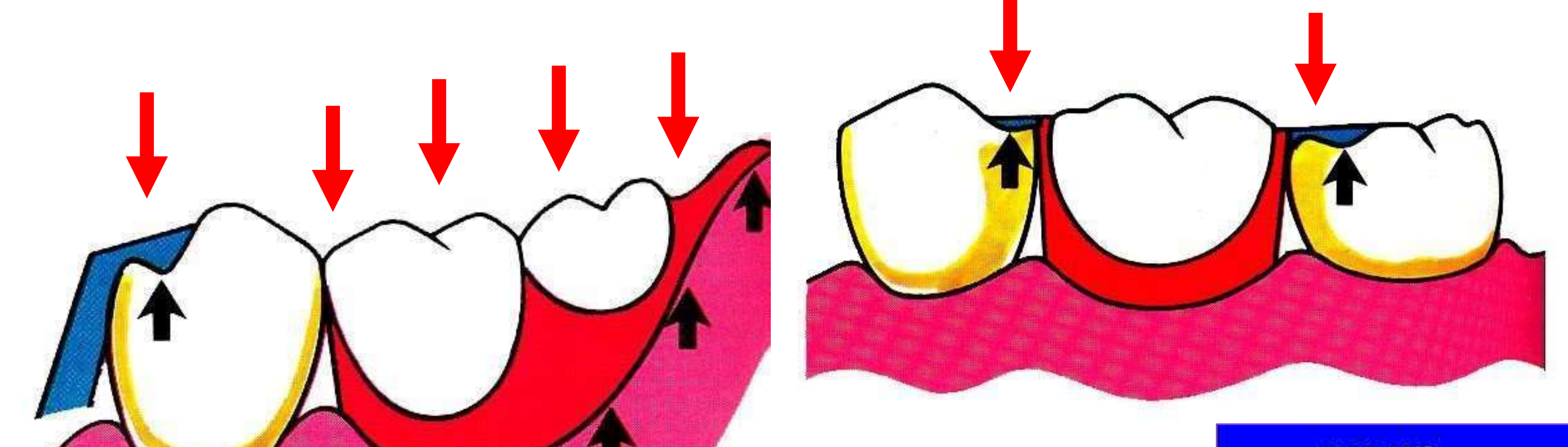
IV. Rotational movements

1 Rotation around fulcrum axis (transverse)

2 Rotation around longitudinal axis

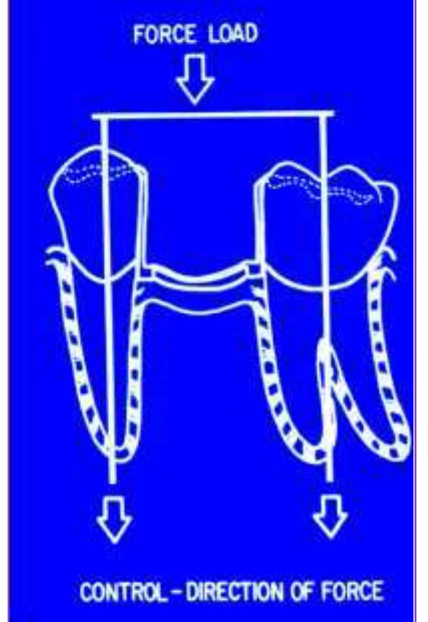
3 Rotation around perpendicular axis (vertical)

I- Tissue-ward movements



Control direction of force

Vertical forces acting in gingival direction tending to move the denture towards the tissues



They occur during

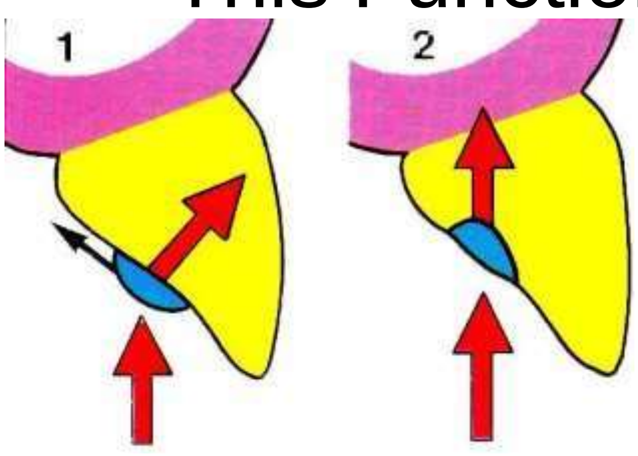
- **Mastication, Swallowing And Aimless Tooth Contact. Biting Forces**

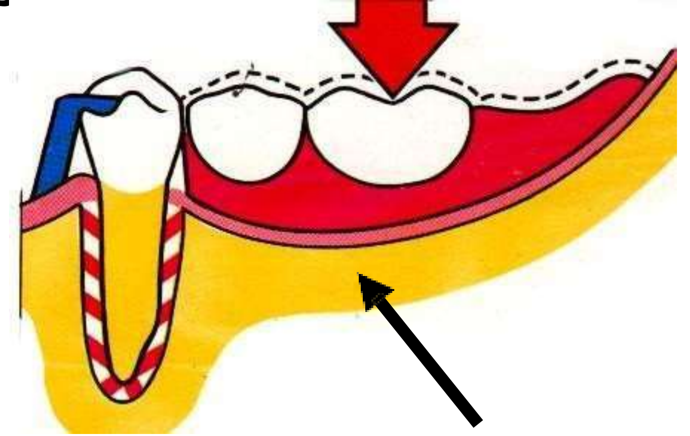
- ***P.D. should be designed to resist this movement by providing*** adequate supporting components

- **This function of the partial denture is called**

"Support"

This Function Is Mainly Provided By:





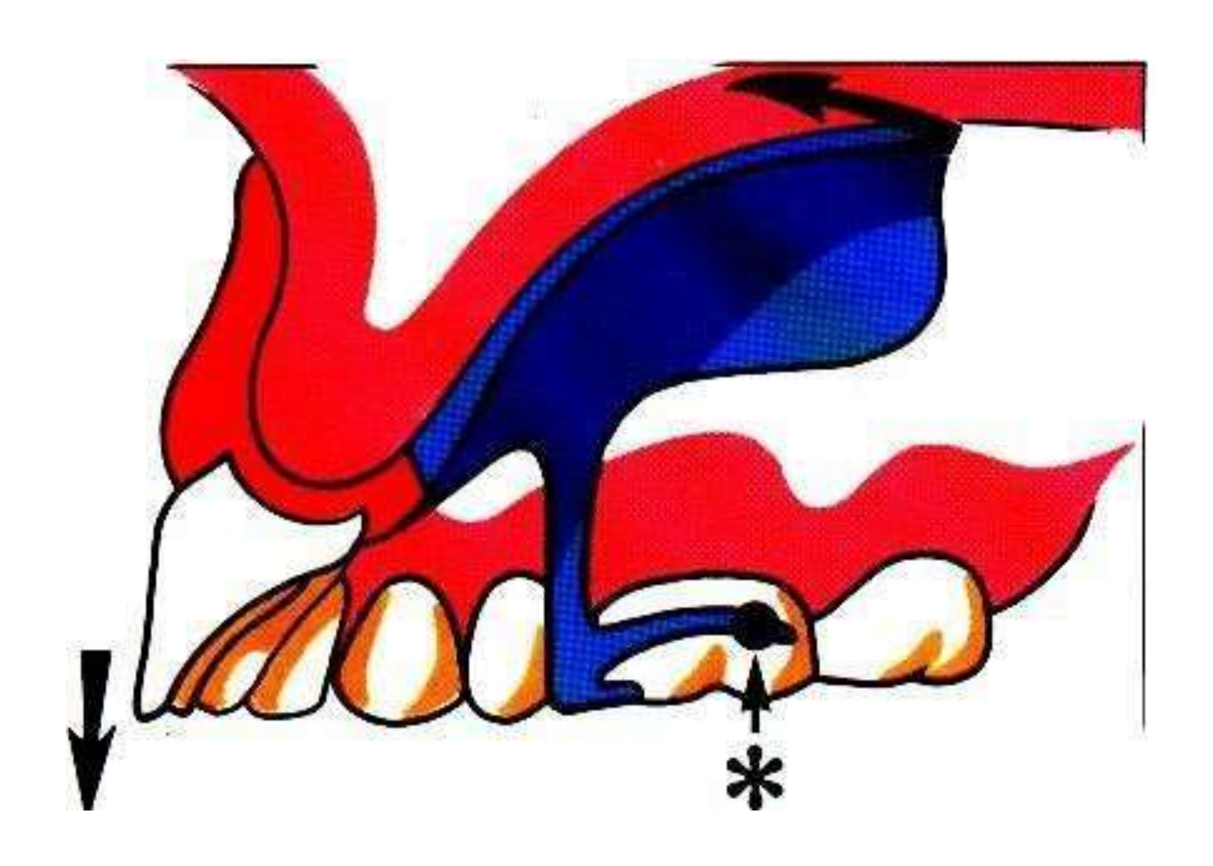
Properly designed supporting *rests* placed in rest seats, which are prepared on the abutment teeth,

Broad accurately fitting denture bases in distal extension partial dentures.

***Rigid major connectors* that are neither relieved from the tissues nor placed on inclined planes also provide support**



II- Tissue-away movements



Tissue-away forces occur due to

The action of <u>muscles</u> acting along the **periphery of the denture**

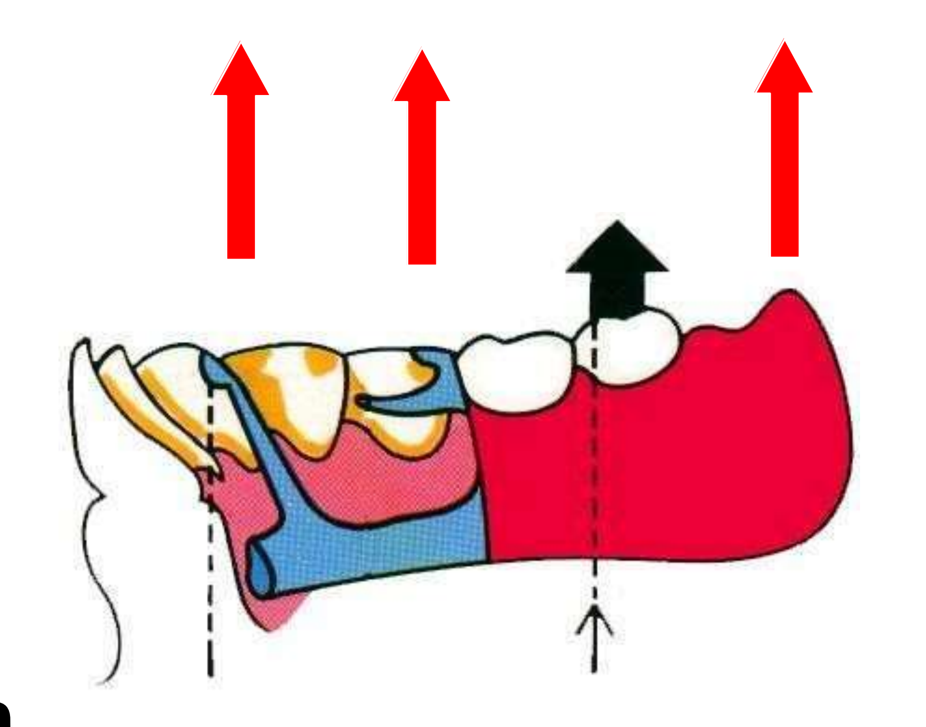
<u>Gravity</u> **acting on upper dentures or by *<u>sticky food</u>* adhering to the artificial teeth or to the denture base.**

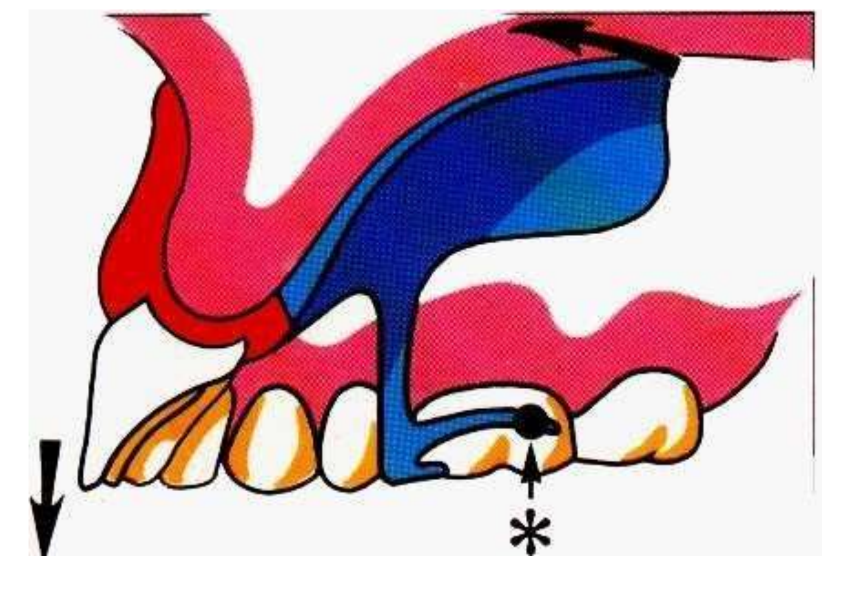
- **This function of the partial denture is called**

“Retention”

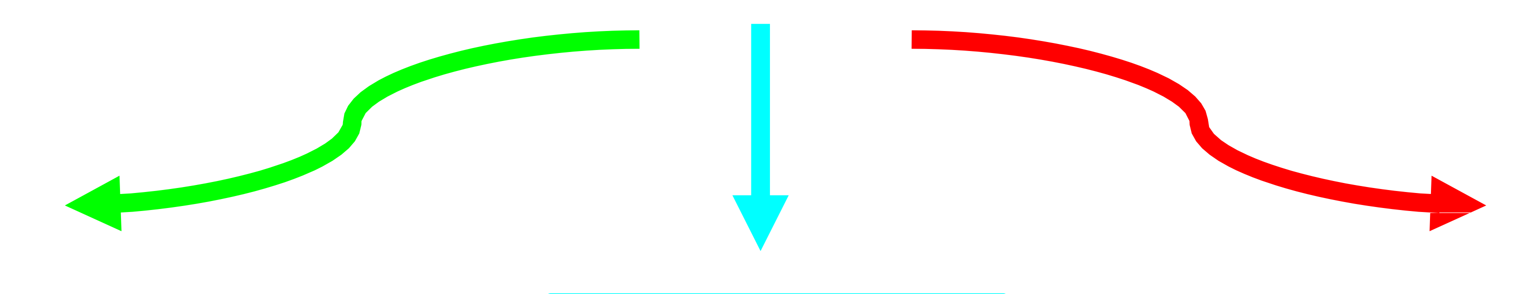
Retention

Resistance to movement of the denture away from its tissue foundation (resistance of a denture to dislodgment)



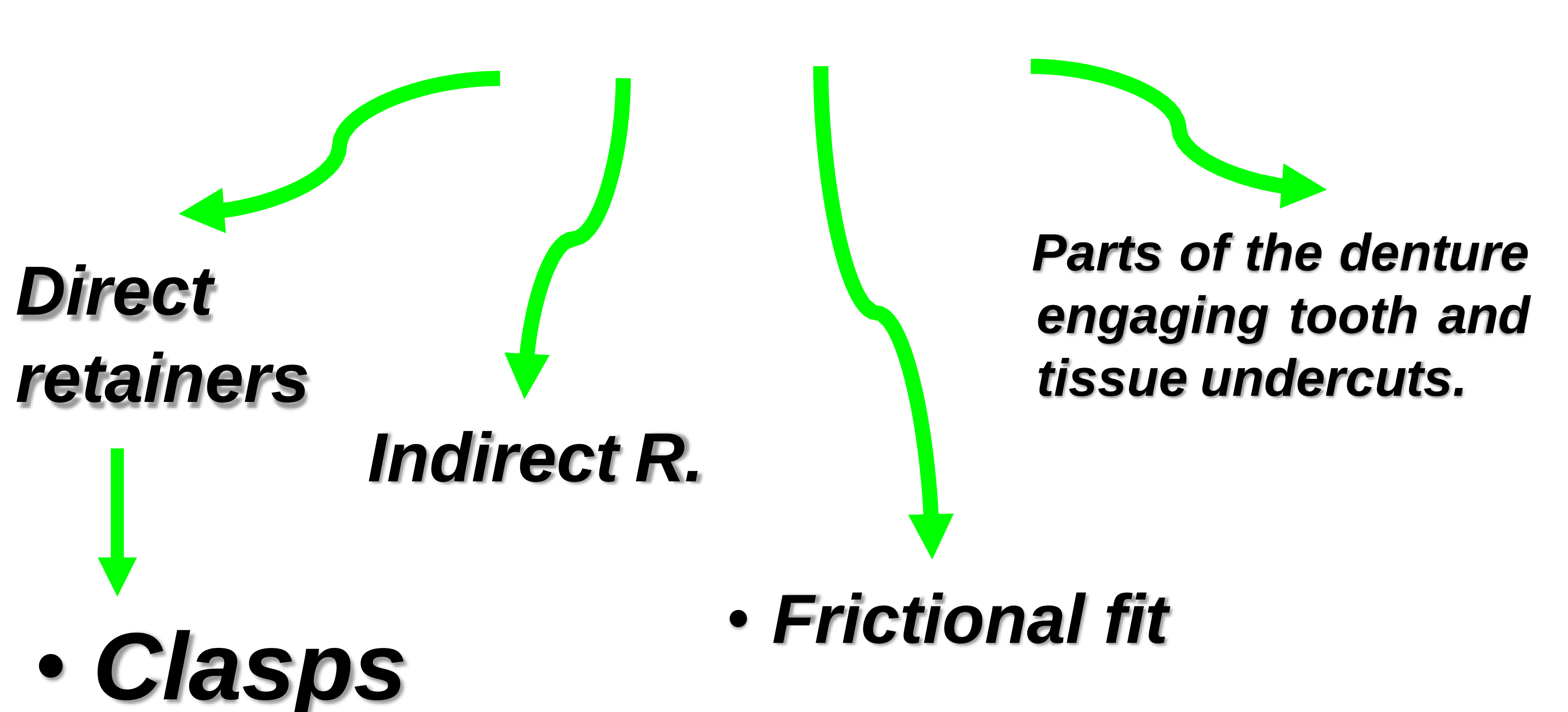


Retention



Mechanical	Physical	Physiological
• *Direct retainers* • *Indirect R.* • *Frictional fit* • *Parts of the denture engaging tooth and tissue undercuts.*	*1-Adhesion* *2-Cohesion* *3-Interfacial s.t.* *4-At. pressure* *6-Gravity*	*-The physiologic molding* of the tissues around the polished surfaces *- neuromuscular control*

Mechanical means of Retention



- **Clasps**
- **Attachments**

The effect of physical forces is less applicable to lower dentures than upper because:

1. **Have less surface area.**
2. **Are bathed in saliva.**
3. **Lower major connectors are relieved.**

contrary to upper m. c. that are well adapted and their borders are beaded against the underlying tissues.

4. **Strong movements of the tongue**

Horizontal movements

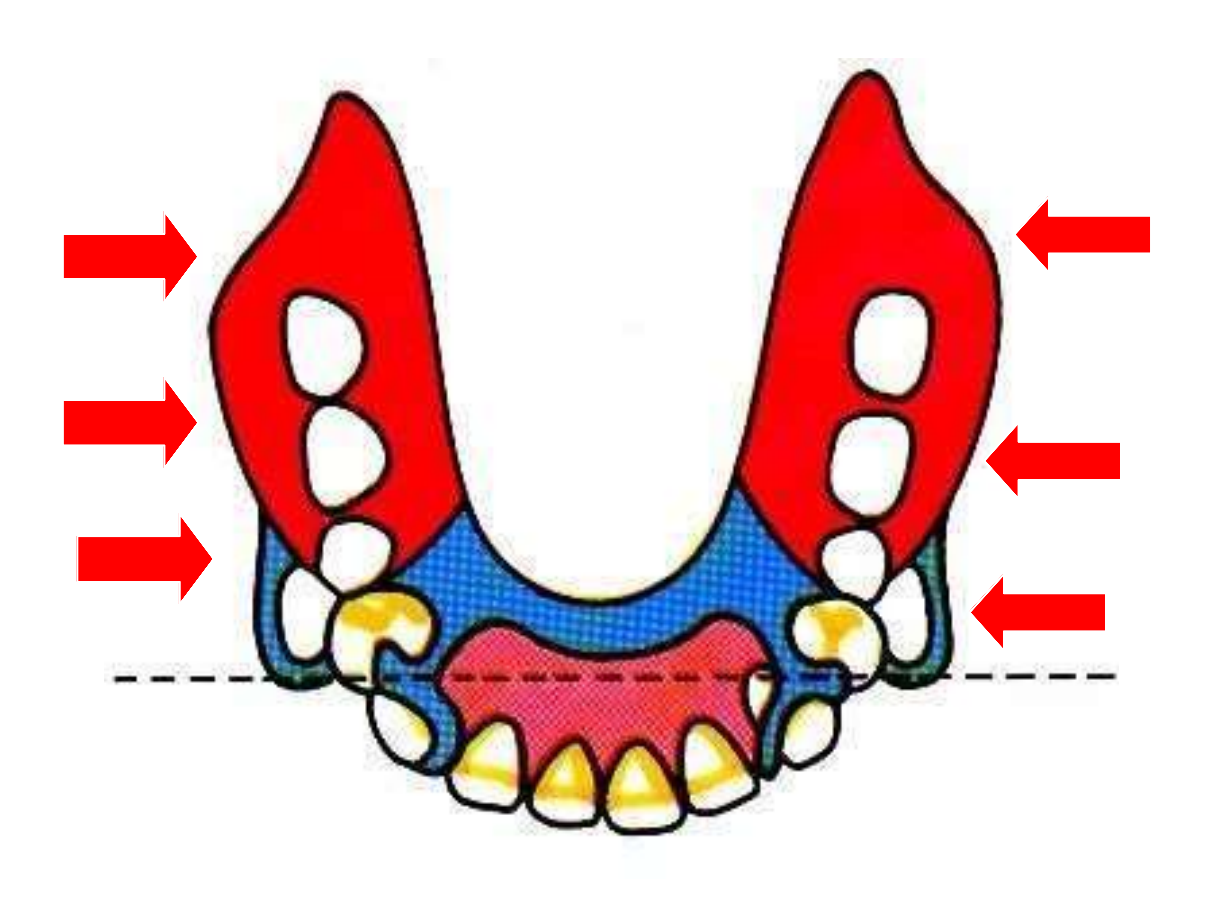
A) Lateral movements

Horizontal forces developed when the mandible moves from side to side during function while the teeth are in contact

Lateral movements have ***a***
destructive effect
on teeth leading to tilting, breakdown of the periodontal ligament and looseness of abutment teeth.

Bracing

Resistance to Lateral Movement of the Partial Denture



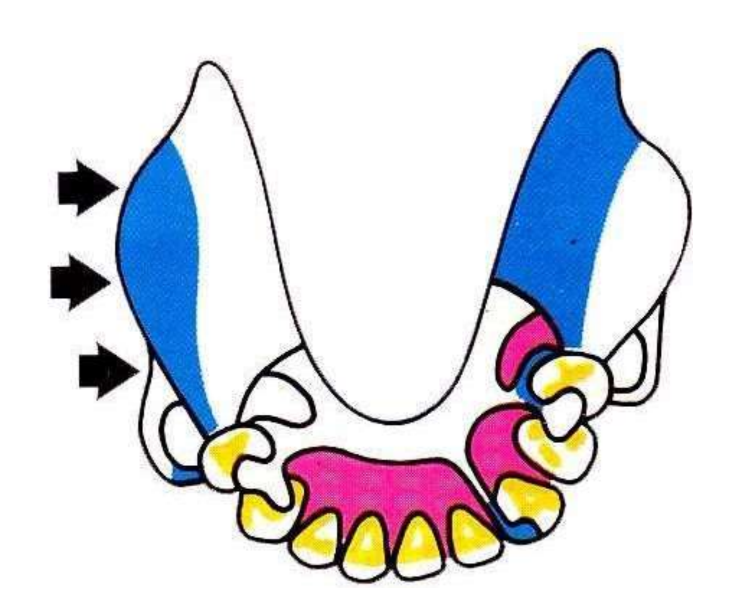
This Function Is Mainly Provided By:

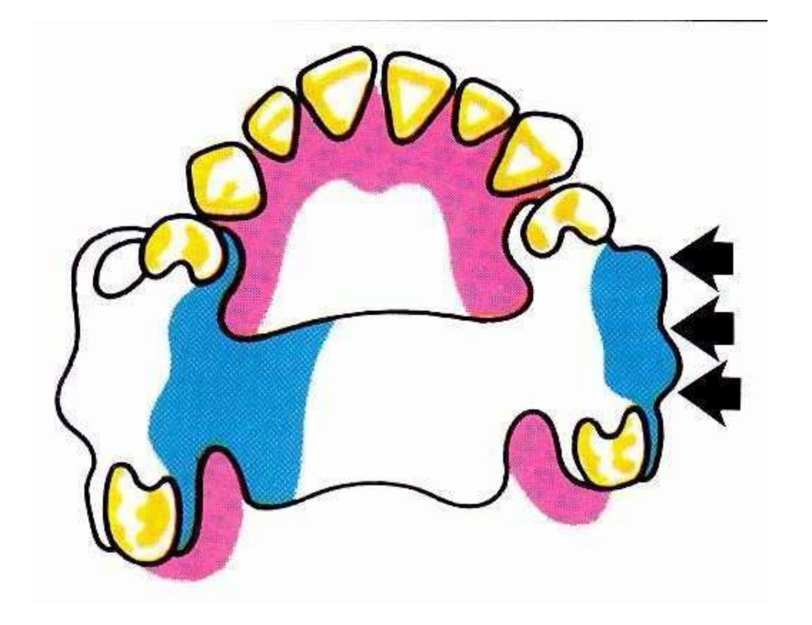
Bracing clasp arms placed at or above the survey line of the tooth.

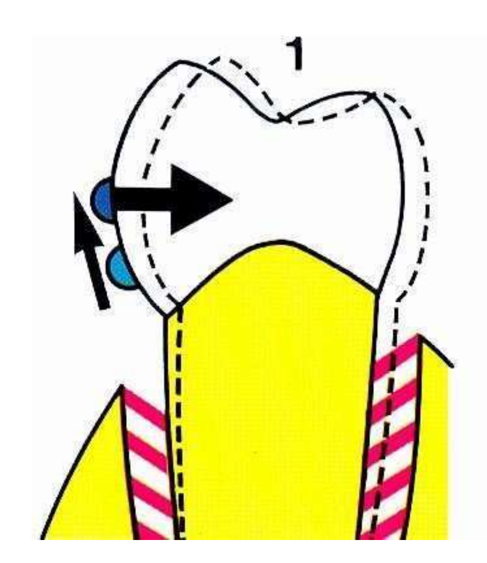
Minor connectors **in contact with axial (vertical) surfaces of abutment teeth**

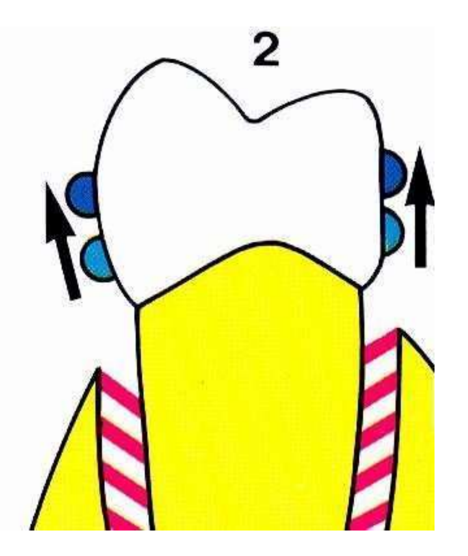
Proximal plates

Adequate extension **of the flanges**






1


2

BRACING

Lateral movement is resisted by:

- ***Maximum extension*** and coverage of the sides of the residual ridge with the denture base within the physiological limit.
- ***Rigid bracing*** clasp arms.
- Use of a ***continuous bar*** resting on the lingual surfaces of natural standing teeth (Kennedy bar).
- ***Rigid*** minor connectors
- Reduction of ***cusp angle*** inclination of the artificial teeth and balanced occlusion.
- Reduced ***occlusal table***.

Horizontal movements

B) Antero-posterior movements

Horizontal forces which occur during forward and backward movement of the mandible

during function while the teeth are in contact

There is natural tendency for the *upper* denture to *move forward* and for the *lower* to move *backward*.

Horizontal movements

B) Antero-posterior movements

Forward movement of the upper denture could be resisted by:

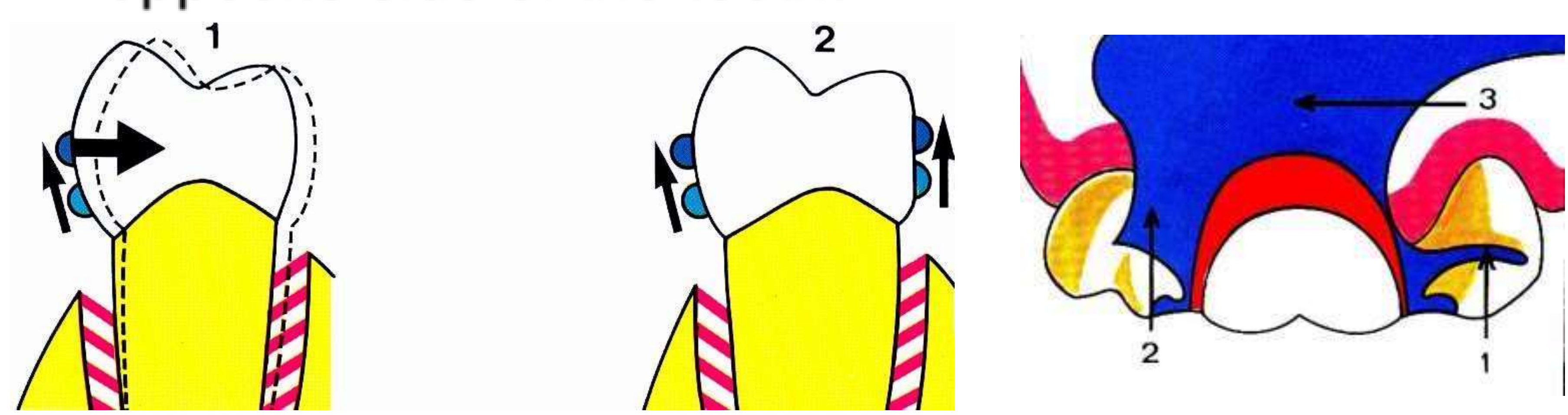
Anterior natural teeth.
Palatal slope.
Maxillary tuberosity.
The natural teeth bounding the edentulous space.

The backward movement of the lower denture could be resisted by:

The slope of the retromolar pad.
The natural teeth bounding the saddle area.
Proximal plates.

Reciprocation

- Nullifying the effect of pressure on one side of the teeth by application of pressure, equal in amount, but in an opposite direction, on the opposite side of the teeth.



Proximal view

Retention distance ??????

RECIPROCATION

RECIPROCATION *can be achieved by:*

- Reciprocal clasp arms contacting the tooth prior to or at the same time the retentive tip crosses the survey line of the tooth.
- Parts of the major connectors……..?????
- Proximal plates.
- Cross arch reciprocation should also be provided.

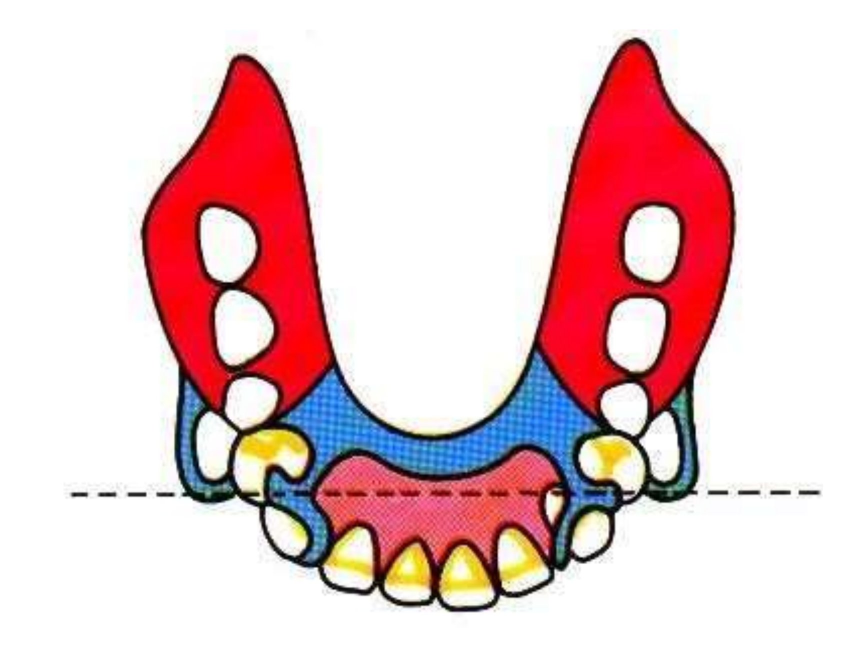
IV- Rotational movements

Rotational movements are due to **the variation in compressibility** of supporting structures, **absence of distal abutment** at one end or more ends of denture bases, and /or **absence of occlusal rests or clasps beyond the fulcrum line.**

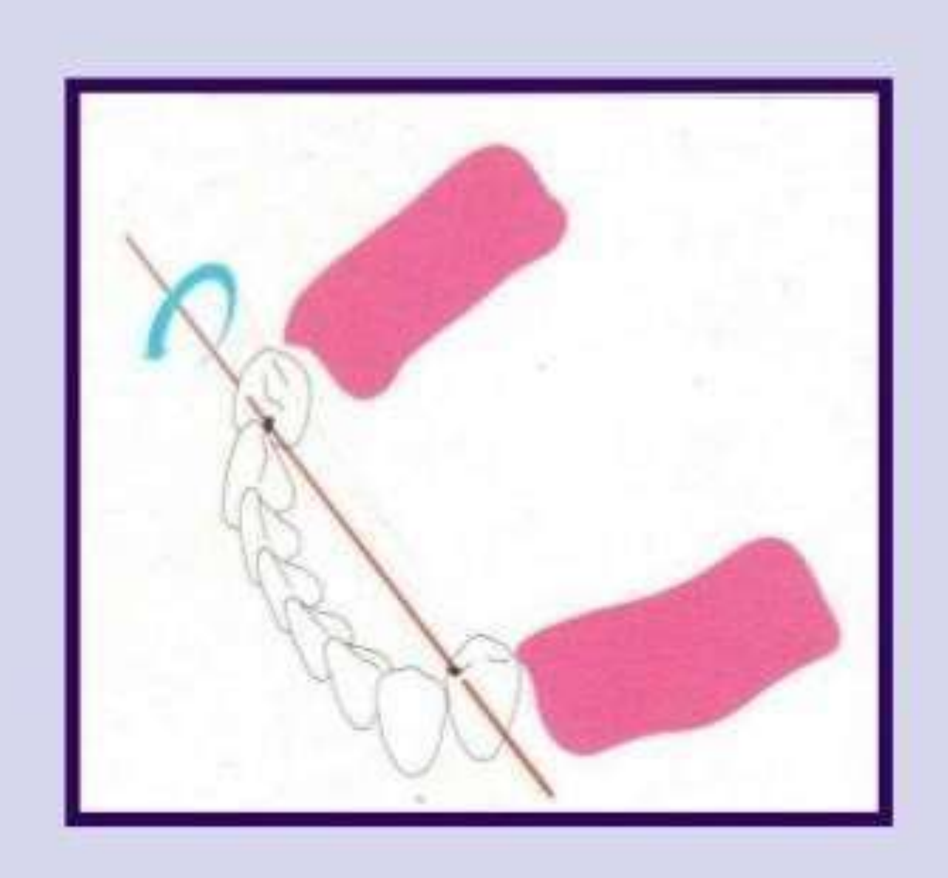
1-Rotation of the extension denture base around transverse fulcrum axis:

A) Rotation of the denture base towards the ridge around the fulcrum axis joining the two main occlusal rests

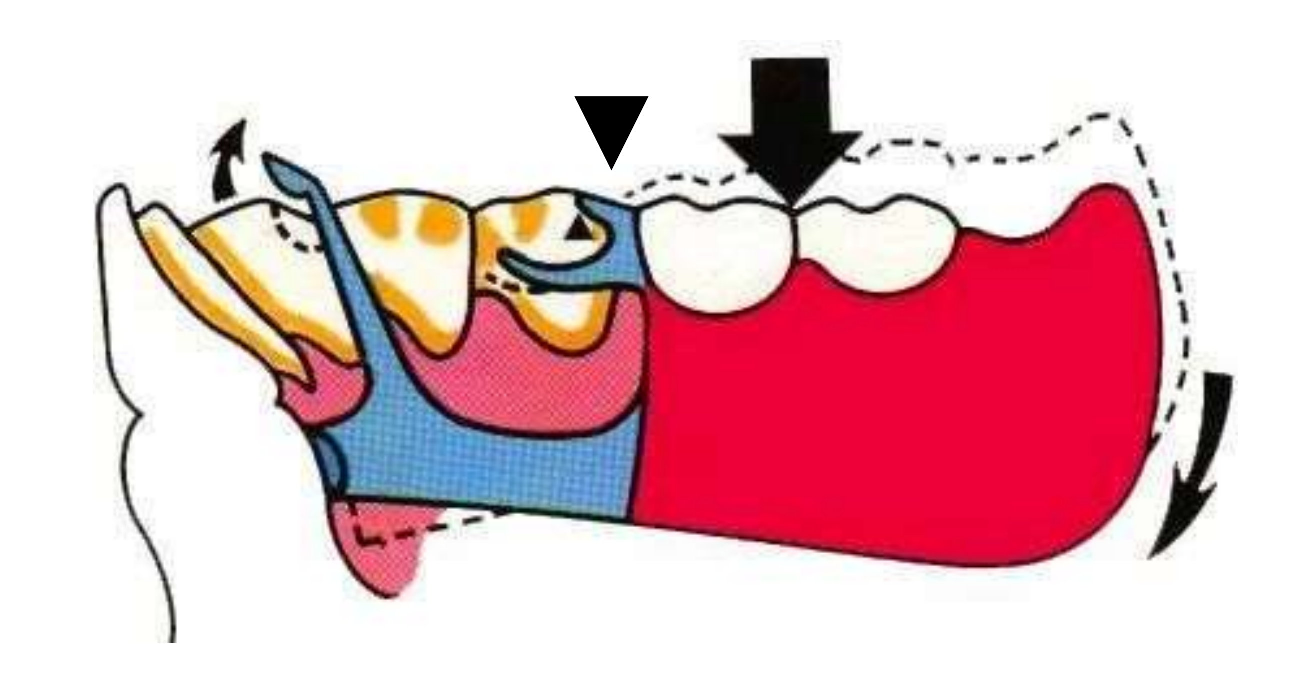
B) Rotation of the denture base away from the ridge around the fulcrum axis joining the two main occlusal rests



ROTATION AROUND A TRANSVERSE AXIS

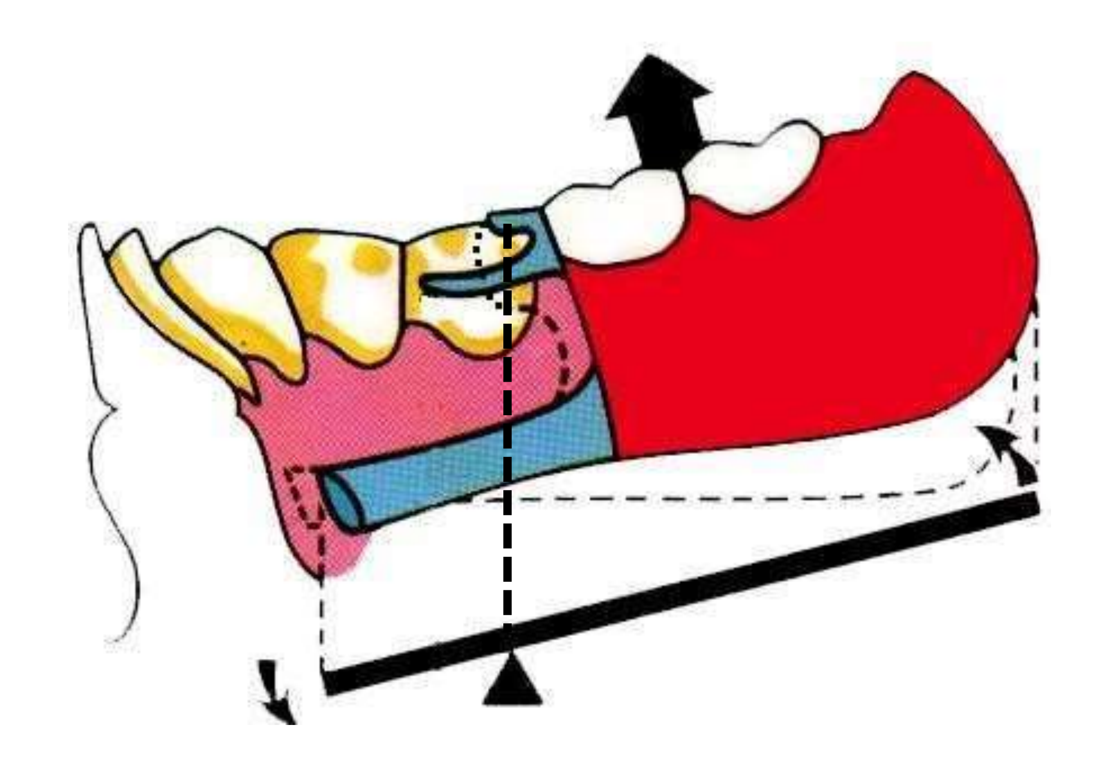


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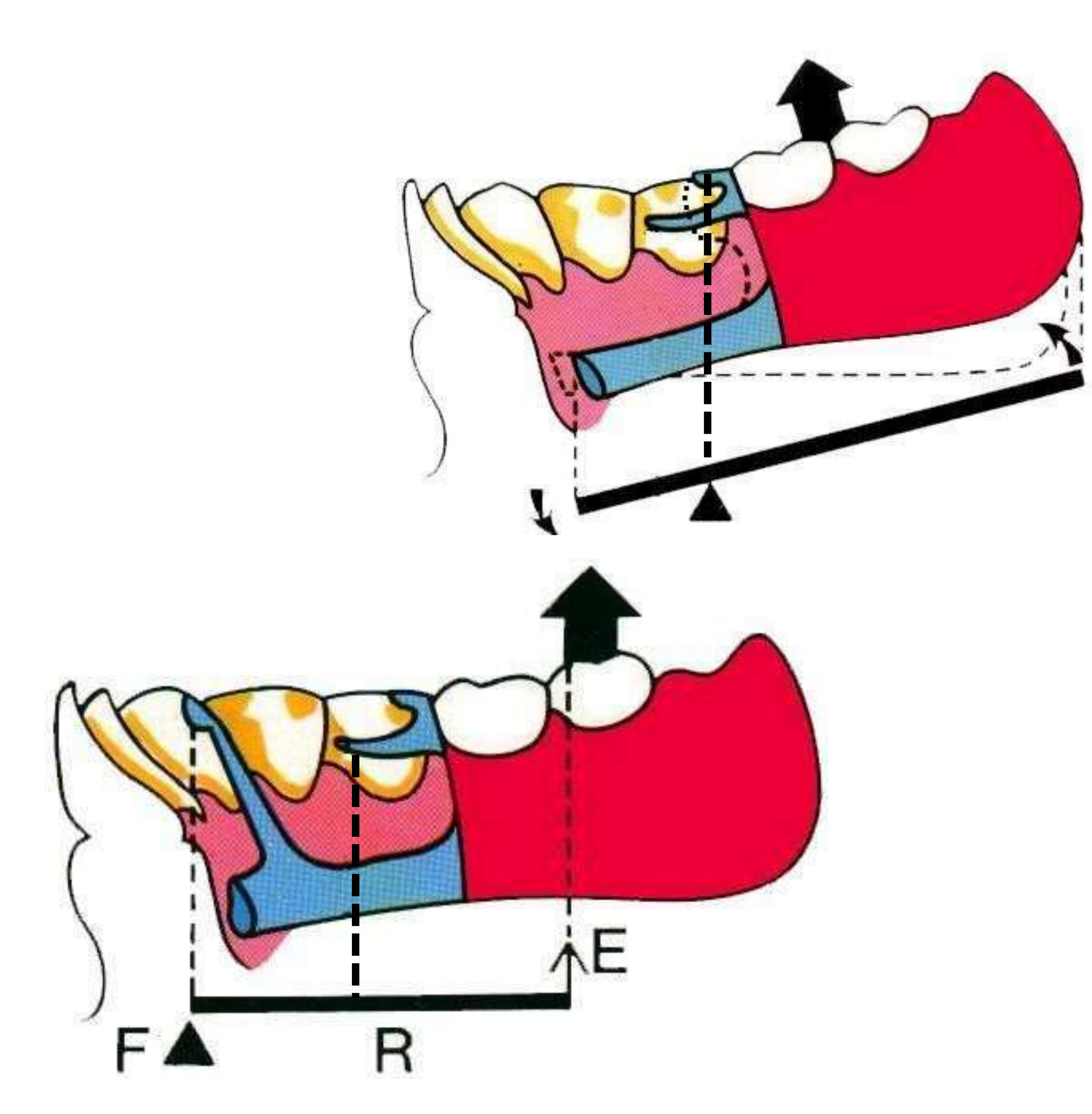
1-Rotation of the extension denture base around transverse fulcrum axis:



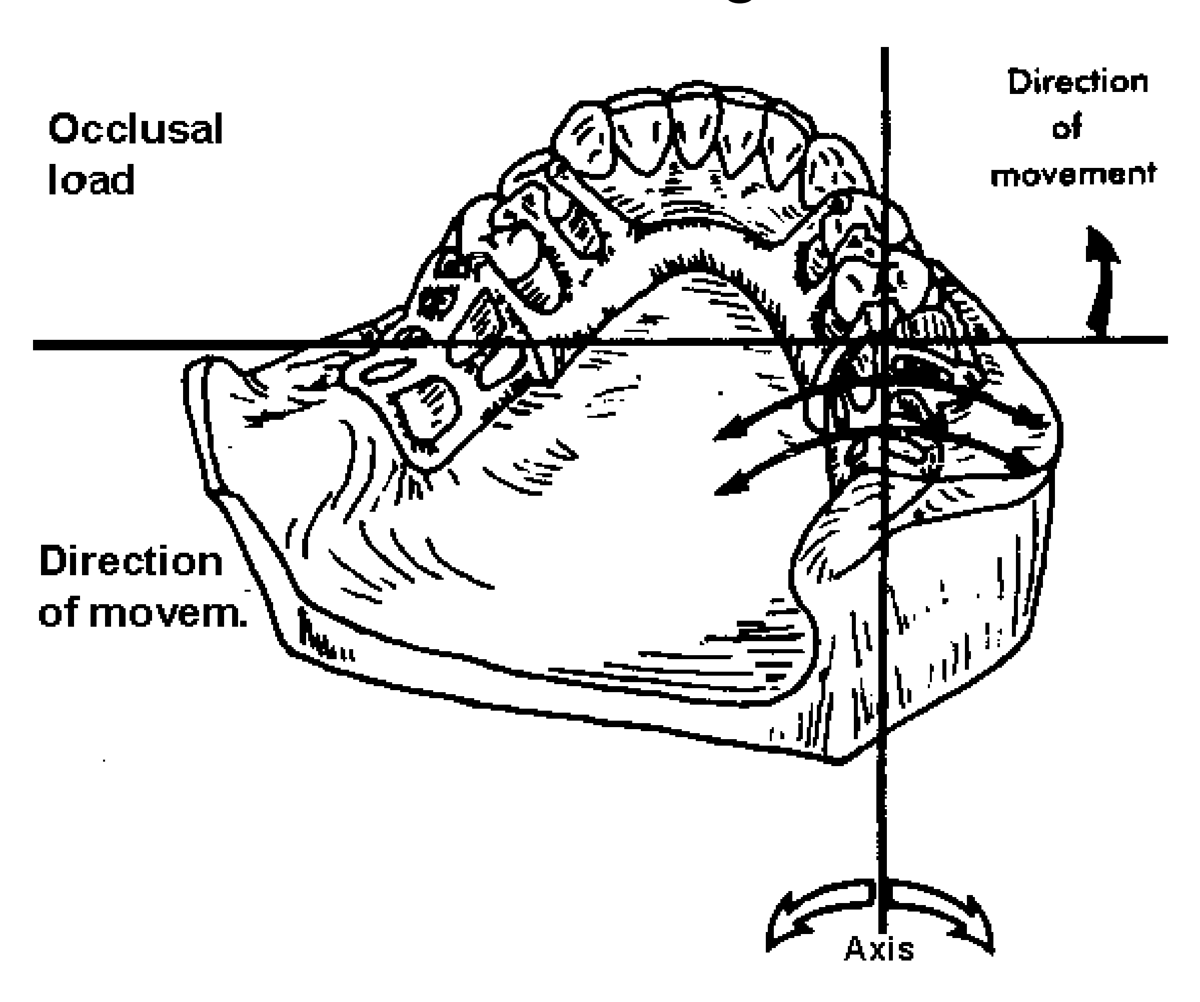
B) Rotation of the denture base away from the ridge around the fulcrum axis joining the two main occlusal rests

Indirect Retention

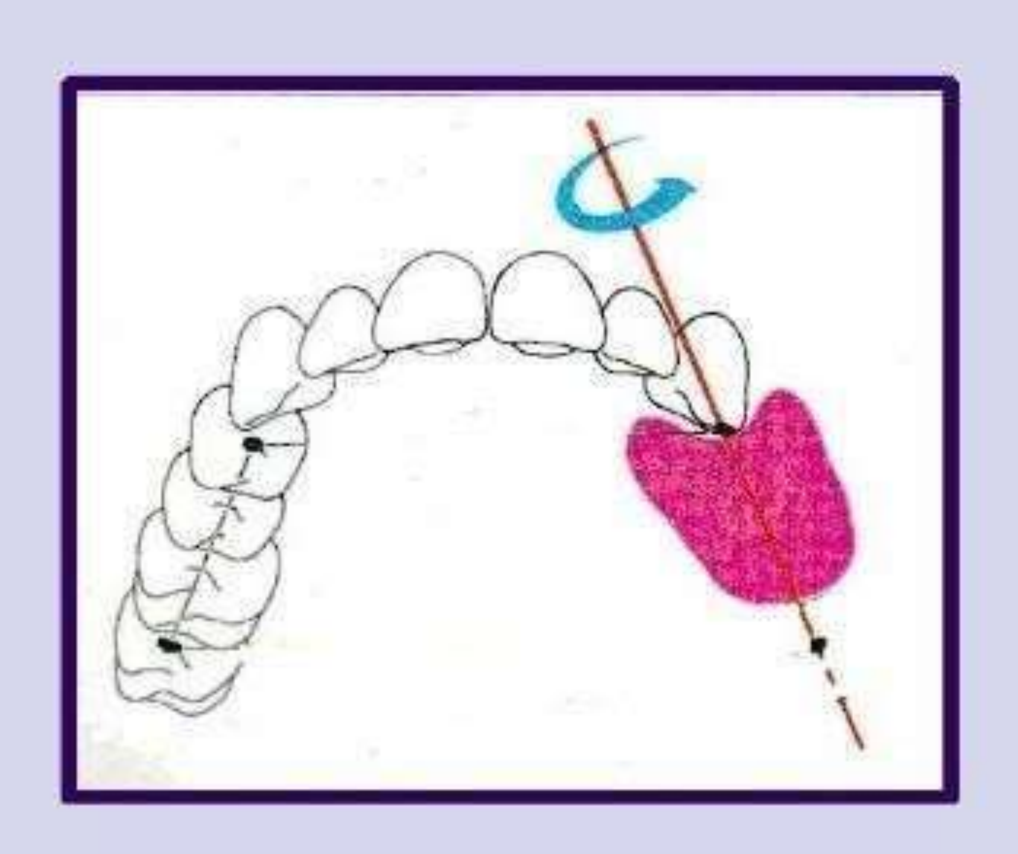
Components of RPD That Are Used to Reduces the Tendency the Denture to Rotate in an Occlusal Direction About the Fulcrum Axis



2-Rotation of all bases around a longitudinal axis parallel to the crest of the residual ridge

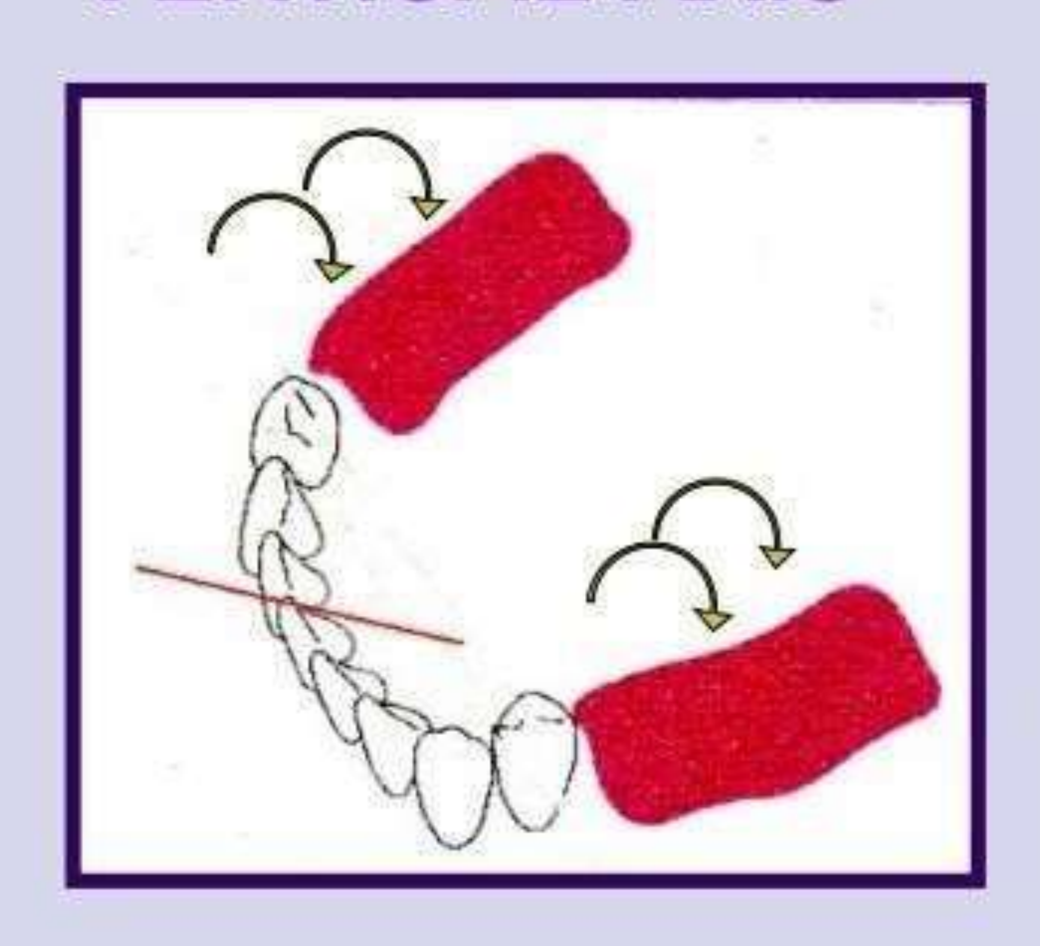


ROTATION AROUND A LONGITUDINAL AXIS

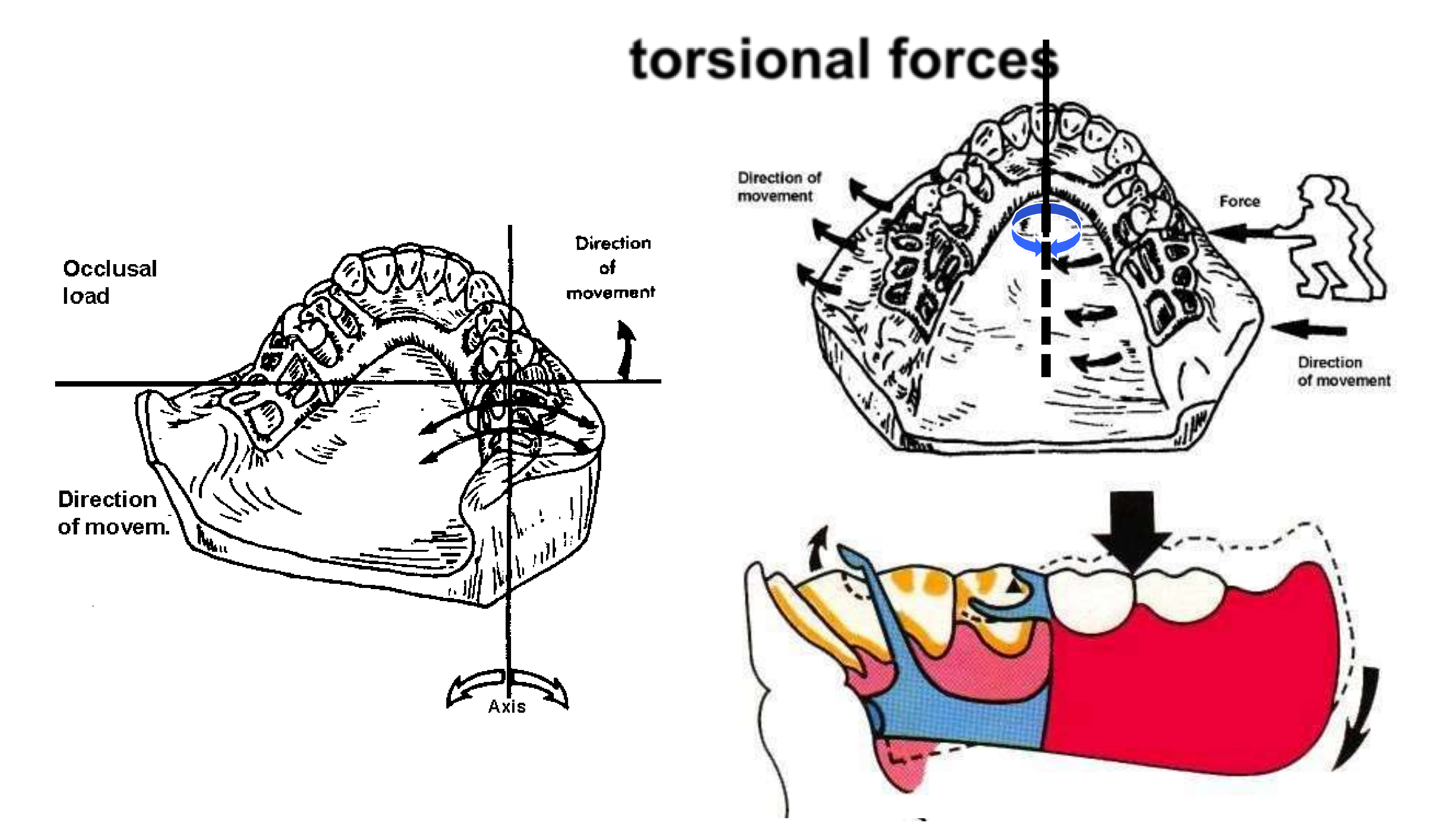


3-Rotation about an imaginary perpendicular axis

ROTATION AROUND A VERTICAL AXIS



Stabilization



This movement is counteracted by :

Providing adequate bracing

A rigid major connector.

Broad base coverage

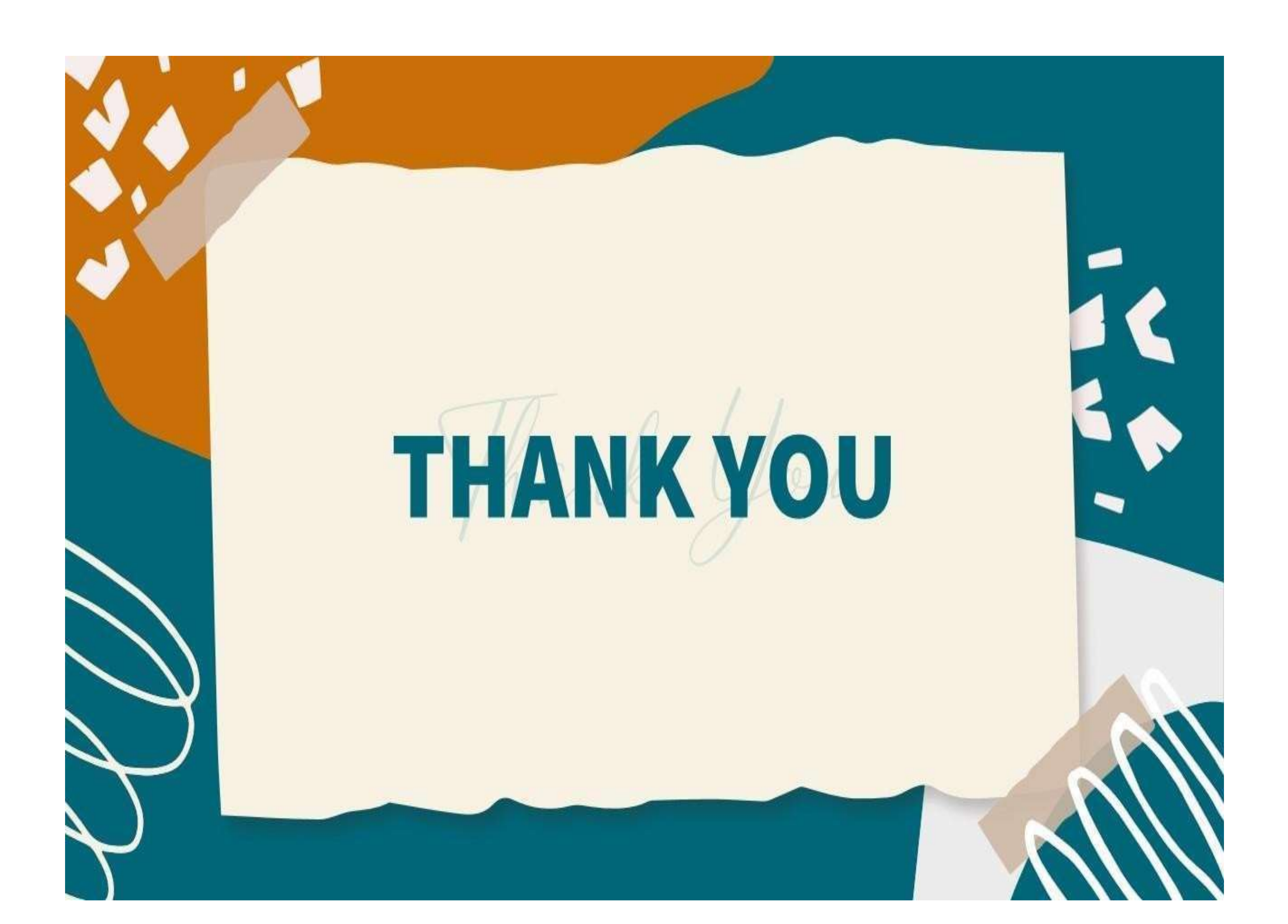
Balanced contact between upper and lower teeth and reduction of cusp slope.

The use of additional rests on teeth other than the abutment tooth serves as, indirect retainers.

Coverage of the sloping part of the palate ant. (rugea area) acts as an indirect ret.

Reference

- **The Glossary of prosthodontic terms.** The journal of prosthetic dentistry, 9th edition, 2017.
- **McCracken, S.:** Removable Partial Denture Prosthodontics, 12"d ed. St. Louis, Mosby Co. 2011.


THANK YOU